

Racial Disparities in Receipt of Influenza and Pneumococcus Vaccinations Among US Nursing-Home Residents

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The nation's 1.6 million nursing-home residents are particularly vulnerable to influenza and pneumococcus infections because of their advanced age, increased level of functional disability, and presence of multiple chronic conditions such as diabetes, asthma, and heart or lung disease.^{1–4} Among Americans aged 65 years and older, every year influenza causes 190 000 excess hospitalizations and 33 000 deaths,^{5,6} and pneumonia causes 3400 deaths.⁷ Vaccinations against these infections are generally efficacious, safe, and cost-effective in nursing homes.^{8–10} For more than 10 years the federal Advisory Committee on Immunization Practices has recommended universal influenza and pneumococcus vaccinations in nursing homes.^{11,12} However, previous estimates show that nursing home immunization coverage is only 60% for influenza and 40% for pneumococcus bacteria infection.¹³ In addition, the vaccination history of a sizable number of nursing-home residents is not routinely assessed, tracked, or documented,^{14,15} further preventing them from receiving appropriate vaccines.

Racial minorities make up about 16% of the nursing-home population, and minorities tend to be cared for in resource-poor facilities characterized by predominance of Medicaid reimbursement, less staffing by registered nurses, and higher rates of care deficiencies.^{16,17} Nevertheless, despite the considerable evidence substantiating racial disparities in vaccine uptake among populations in the larger community,^{18–22} little is known about the extent to which minority nursing-home residents receive suboptimal care, either preventive care or broader aspects of institutionalized care.^{23–26} Only 1 study has tried to examine racial differences in pneumococcal vaccination in this setting.²⁷ That study was based on data from the 1997–1999 National Nursing Home Surveys (NNHSs) and reported inconsistent results across facilities.

The purpose of our study was to characterize racial disparities in influenza and pneumococcus immunizations in a more recent and

Objectives. We examined racial disparities in receipt and documentation of influenza and pneumococcus vaccinations among nursing-home residents.

Methods. We performed secondary analyses of data from a nationally representative survey of White (n=11448) and Black (n=1174) nursing-home residents in 2004. Bivariate and multivariate analyses determined racial disparities in receipt of influenza vaccination in 2003 and 2004, receipt of pneumococcus vaccination ever, and having a documented history for each vaccination.

Results. The overall vaccination rate was 76.2% for influenza and 48.5% for pneumococcus infection. Compared with Whites, Blacks showed a 13% lower vaccination rate and a 5% higher undocumented rate for influenza, and a 15% lower vaccination rate and a 7% higher undocumented rate for pneumococcus. For influenza, the odds ratio (OR) for Blacks being unvaccinated was 1.84 ($P \leq .001$), and the OR for Blacks having undocumented vaccination was 1.85 ($P = .001$). For pneumococcus infection, the OR for Blacks being unvaccinated was 1.70 ($P \leq .001$), and the OR for Blacks having undocumented vaccination was 1.95 ($P \leq .001$). Stratified analyses confirmed persistent racial disparities among subpopulations.

Conclusions. Racial disparities exist in vaccination coverage among US nursing-home residents. Targeted interventions to improve vaccination coverage for minority nursing-home residents are warranted. (*Am J Public Health*. 2010;100:S256–S262. doi:10.2105/AJPH.2009.173468)

nationally representative sample of nursing-home residents. We tested whether Black residents were less likely than were Whites (1) to receive each vaccination and (2) to have a documented status for each vaccination, either in the overall nursing-home population or in subpopulations defined by key demographic or facility characteristics.

METHODS

We obtained the public-use resident file of the Centers for Disease Control and Prevention's 2004 NNHS, which includes a nationally representative sample of nursing homes, their residents, and the services the residents received.²⁸ The file provides patient information on demographic and functional characteristics; length of stay; primary diagnosis and up to 15 secondary diagnoses recorded using codes from the *International Classification of Diseases, Ninth Revision, Clinical Modification*; services

received; and sources of payment. The survey collected facility data on geographic location, profit status, and number of beds. The resident data were obtained through personal interviews with facility administrators and designated staff members, who reviewed the patients' regular medical records and other documents, such as the Minimum Data Set, to answer questions about the patients. Nursing-home residents were not interviewed.

The 2004 NNHS involved a stratified 2-stage probability design.²⁸ The first stage was the selection of nursing homes stratified by geographic location (state, county, and zip code), bed-size category (number of beds), and ownership status (profit vs nonprofit). Nursing homes were finally selected by systematic sampling, with the probability proportional to bed-size category. The second stage, sampling of current residents, was carried out by interviewers at the time of their visits to the facilities. Individuals were randomly selected from patient rosters, and

a sample of up to 12 current residents per facility was selected for the final interview. The final NNHS comprised 13 507 residents in 1174 nursing homes, with an overall response rate of 78%.

Participants and Variables

Our analyses were limited to 11 448 non-Hispanic Whites and 1384 Blacks, excluding 765 residents (5.7%) of other races/ethnicities (Hispanic, American Indian/Alaska native, Asian, native Hawaiian/other Pacific Islander, and other race). The 2 outcome variables of interest were the resident’s vaccination status for influenza and pneumococcus bacteria infection, with each coded as vaccinated (i.e., the resident had documentation of having received the vaccine), unvaccinated (i.e., the resident had documentation of having not received the vaccine), or vaccination status undocumented. In the analyses of influenza vaccination, 2270 residents were further excluded because they were medically contraindicated for vaccination (n=71), were offered the vaccine but refused to receive it (n=617), or were not in the nursing home during the most recent flu season (n=1582). In the analyses of pneumococcus vaccination, 698 residents were excluded because they were medically contraindicated (n=39) or were offered but refused to receive the vaccine (n=659). The final sample comprised 10 562 residents for the analysis of influenza vaccination and 12 134 residents for the analysis of pneumococcus vaccination.

We analyzed a set of resident and facility variables that, according to previous studies,^{13–15,27} may be associated with receipt of vaccination. Resident variables were race (Black or White), age in years, female (yes or no), veteran status (yes or no), length of stay (≥6 months vs <6 months), payment source (Medicare, Medicaid, private, and other payment), difficulties in activities of daily living (ADLs), and a set of indicator variables defining whether the resident had depressed mood, behavioral symptoms, and current diagnoses of dementia, heart disease, chronic pulmonary disease, asthma, diabetes, and chronic renal disease. ADLs included bed mobility, transfer, dressing, eating, toileting, personal hygiene, and bathing. Each ADL component was coded in 5 categories from 0 (independent) to 4 (totally dependent), resulting in

a total range of the aggregate ADL score of 0 to 28. Facility covariates included profit status (for profit vs nonprofit), number of beds (<50, 50–99, 100–199, and ≥200), and geographic location (metropolitan, micropolitan, and rural area).

Analyses

We performed bivariate and multivariate analyses that accounted for the complex sampling methodology, including stratification, clustering, and weighting. Therefore, our analyses pertain to the population of White and Black nursing-home residents in the United States. In bivariate analyses, we compared

individual characteristics between Whites and Blacks, using the *t* test for continuous variables and the χ^2 test for categorical variables. We also performed the χ^2 test to determine bivariate associations between the resident’s vaccination status and the resident and facility covariates described previously (age was categorized as <65 years, 65–84 years, and ≥85 years; number of ADLs was categorized as ≥16 and <16).

In multivariate analyses, we first estimated 2 separate multinomial logistic regression models of the resident’s vaccination status (vaccinated, unvaccinated, and undocumented) for influenza and pneumococcus infection,

TABLE 1—Population Characteristics: National Nursing Home Survey, 2004

	Total (N=12 832)	White (n=11 448)	Black (n=1384)	<i>P</i> ^a
Population size, no.	1 408 749	1 225 852	182 897	
Age, y, mean ±SE	80.8 ±0.2	81.7 ±0.2	75.0 ±0.7	≤.001
Female gender, %	71.9	73.2	63.3	≤.001
Veteran, %	6.9	7.2	5.1	.016
Length of stay ≥6 mo, %	70.2	70.0	71.2	.426
Payment source for the past mo, %				≤.001
Medicare	6.5	6.6	5.5	
Medicaid	57.1	54.7	72.7	
Private	7.4	8.0	3.7	
Other	29.1	30.7	18.2	
No. of difficult ADLs, mean ±SE	16.5 ±0.1	16.4 ±0.1	17.3 ±0.3	.003
Indication of depressed mood, %	42.9	43.7	37.6	.003
Any behavioral symptoms, %	27.8	27.9	27.3	.751
Dementia, %	18.5	19.2	14.2	≤.001
Heart disease, %	20.9	21.4	17.6	.012
Chronic pulmonary disease, %	13.3	13.8	10.2	≤.001
Asthma, %	2.4	2.3	3.4	.044
Diabetes, %	23.8	22.4	32.9	≤.001
Chronic renal disease, %	2.3	2.1	3.4	.006
For-profit nursing home, %	61.3	59.2	75.2	≤.001
No. of nursing-home beds, %				≤.001
<50	4.2	4.6	1.8	
50–99	28.5	29.8	20.0	
100–199	52.9	52.4	56.2	
≥200	14.4	13.3	22.1	
Location, %				≤.001
Metropolitan	75.0	73.6	84.5	
Micropolitan	13.8	14.5	9.0	
Rural	11.2	11.9	6.4	

Note. ADLs=activities of daily living. ADLs include bed mobility, transfer, dressing, eating, toileting, personal hygiene, and bathing.

^aComparing Blacks and Whites, based on the χ^2 test for categorical variables and the *t* test for continuous variables.

using vaccinated residents as the reference (omitted) group in each model. Each model used race as the key independent variable and controlled for other resident and facility covariates described before.

To further determine the independent impact of race on the likelihood of receiving or having documentation of each vaccination within subgroups of nursing home residents, we estimated additional sets of multivariate, multinomial logistic models that were stratified by resident age (<65 years or ≥65 years), length of stay (<6 months or ≥6 months), payment source (Medicaid or non-Medicaid), facility profit status (for profit or nonprofit), bed size (≥100 beds or <100 beds), and geographic location (rural or nonrural). Stratified models controlled for all covariates except for the covariate used for stratification.

We reported odds ratios (ORs) and associated *P* values estimated from each model. All statistical analyses were performed using the survey estimation routines available in the software package Stata version 8.0, Special Edition. Multilevel modeling²⁹ was not used because the survey estimates already incorporate variations at both the patient and the nursing-home levels.

RESULTS

Table 1 presents the population estimates of White and Black residents in 2004. Black residents accounted for 13% (n=182 897) of the total population (N=1 408 749). Compared with White residents, Black residents were 7 years younger (aged 75 years vs 82 years on average) and 10% less likely to be female (63% vs 73%), and they had a slightly higher number of impaired ADLs (17.3 vs 16.4 on average). Medicaid was the payment source for 73% of Blacks, compared with 55% of Whites. Compared with White residents, Black residents showed slightly lower rates of depressed mood, dementia, heart disease, and chronic pulmonary disease, but higher rates of asthma, diabetes, and chronic renal disease. In addition, Black residents tended to reside in for-profit, larger, and urban facilities.

Bivariate Predictors

The overall influenza vaccination rate was 76.2%, with the remaining 15% being

TABLE 2—Influenza and Pneumococcus Vaccination Status, by Resident and Facility Characteristics: National Nursing Home Survey, 2004

	Influenza Vaccination Status			<i>P</i>	Pneumococcus Vaccination Status			<i>P</i>
	Residents Vaccinated, % or No.	Residents Unvaccinated, % or No.	Residents Undocumented, % or No.		Residents Vaccinated, % or No.	Residents Unvaccinated, % or No.	Residents Undocumented, % or No.	
All	76.2	15.0	8.8		48.5	32.8	18.7	
Race/ethnicity				≤.001				≤.001
Black	64.7	22.5	12.8		35.2	40.5	24.3	
White	78.0	13.9	8.1		50.5	31.6	17.8	
Age, y				≤.001				≤.001
<65	70.0	19.7	10.4		40.4	38.5	21.1	
65–84	75.3	15.8	8.9		46.7	34.4	18.9	
≥85	78.4	13.3	8.3		52.1	30.0	17.9	
Gender				≤.001				.001
Male	73.0	17.0	10.0		45.0	35.4	19.6	
Female	77.4	14.3	8.3		49.9	31.8	18.3	
Veteran				.066				.538
Yes	80.7	13.1	6.3		50.4	33.4	16.3	
No	75.9	15.2	8.9		48.4	32.8	18.9	
Length of stay				≤.001				≤.001
<6 mo	52.6	30.6	16.8		31.2	44.0	24.9	
≥6 mo	83.4	10.3	6.3		56.0	28.0	16.0	
Payment source for past mo				≤.001				≤.001
Medicare	59.0	27.7	13.3		35.8	45.7	18.6	
Medicaid	81.0	12.4	6.7		52.7	31.3	15.9	
Private	74.1	19.0	6.8		45.3	37.0	17.7	
Other	69.7	17.3	13.1		43.9	31.8	24.3	
No. of difficult ADLs ≥16				.335				.002
Yes	76.7	14.4	8.8		49.5	31.2	19.3	
No	75.4	15.9	8.7		47.1	35.2	17.7	
Indication of depressed mood				.035				.694
Yes	77.9	14.3	7.7		49.2	32.5	18.4	
No	74.9	15.6	9.6		48.0	33.1	18.9	
Any behavioral symptoms				.001				.048
Yes	79.6	12.6	7.8		51.0	30.9	18.1	
No	74.8	16.0	9.2		47.6	33.5	18.9	
Dementia				≤.001				≤.001
Yes	81.1	12.3	6.5		54.3	28.4	17.3	
No	75.0	15.7	9.3		47.2	33.8	19.0	
Heart disease				.171				.004
Yes	78.0	14.1	7.9		50.0	34.0	16.0	
No	75.8	15.3	9.0		48.1	32.5	19.4	
Chronic pulmonary disease				.464				.93

Continued

TABLE 2—Continued

Yes	74.7	16.4	8.9	48.9	32.8	18.3	
No	76.4	14.8	8.8	48.5	32.8	18.7	
Asthma				.714			.568
Yes	73.6	16.8	9.6	51.4	29.6	19.0	
No	76.3	15.0	8.7	48.4	32.9	18.7	
Diabetes				.007			.684
Yes	73.2	17.6	9.2	47.8	33.6	18.5	
No	77.1	14.2	8.6	48.7	32.6	18.7	
Chronic renal disease				.804			.381
Yes	76.8	13.5	9.7	48.3	29.6	22.2	
No	76.2	15.1	8.7	48.5	32.9	18.6	
Profit status				≤.001			≤.001
For profit	72.9	16.9	10.2	41.3	38.0	20.8	
Nonprofit	81.4	12.1	6.6	60.0	24.7	15.3	
No. of beds				.081			.03
< 50	86.6	9.3	4.2	51.8	28.8	19.5	
50–99	78.9	13.7	7.5	49.8	33.4	16.8	
100–199	74.4	15.5	10.0	45.7	32.8	21.6	
≥ 200	74.5	17.4	8.1	55.2	32.9	11.9	
Location				≤.001			.33
Metropolitan	74.0	16.7	9.3	47.4	33.3	19.3	
Micropolitan	80.4	11.8	7.8	51.5	30.9	17.6	
Rural	85.6	7.7	6.7	52.3	31.7	15.9	
Sample size	8321	1413	828	5907	3965	2262	
Population size	887 295	174 991	101 991	642 347	434 544	247 403	

Note. ADLs=activities of daily living. ADLs include bed mobility, transfer, dressing, eating, toileting, personal hygiene, and bathing.

unvaccinated and 8.8% having no documented vaccination status (Table 2). For pneumococcus infection, 48.5% of residents were vaccinated, 32.8% of residents were unvaccinated, and 18.5% of residents had no record documenting their vaccination status. In bivariate analyses of influenza vaccination, Black residents had a 13% lower vaccination rate (64.7% vs 78.0%) and a 5% higher undocumentation rate (12.8% vs 8.1%) than did White residents ($P \leq .001$). In parallel comparisons to Whites, the pneumococcus vaccination rate was 15% lower (35.2% vs 50.5%) for Blacks, and the corresponding undocumentation rate was 7% higher (24.3% vs 17.8%) for Blacks ($P \leq .001$).

In bivariate analyses of both vaccinations, older age, female gender, length of stay of at least 6 months, and Medicaid payment were associated with a higher rate of vaccine uptake and a lower rate of undocumented status (Table 2). However, chronic medical conditions

such as heart disease, lung disease, renal disease, and diabetes were not associated with increased vaccination coverage, although these conditions tend to place patients at higher risks of influenza and pneumococcal complications. Nursing-home characteristics may be associated with varied vaccination practices: residents were more likely to receive both vaccinations and to have their vaccination status documented if they resided in nonprofit rather than for-profit facilities, in smaller facilities, or in rural rather than nonrural facilities. These associations or lack of associations between vaccination status and resident and facility covariates were consistent with previous reports based on national or local samples.^{13–15,27}

Independent Impact of Race

After we controlled for resident and facility covariates, for both vaccinations race remained a significant predictor of not receiving the

vaccination and for having no documentation of receiving the vaccination (Table 3). In the analysis of influenza vaccination, the OR of Black residents was 1.84 for being unvaccinated ($P \leq .001$) and 1.85 for having an undocumented vaccination status ($P = .001$). In the analysis of pneumococcal vaccination, the OR of Black residents was 1.70 for being unvaccinated and 1.9 for having their vaccination status undocumented (in both cases, $P \leq .001$).

Table 4 shows the results of subgroup analyses within residents who are younger or older, long-stay or short-stay, Medicaid or non-Medicaid, in for-profit or nonprofit facilities, in large or small facilities, and in rural or nonrural facilities. In most of these stratified analyses for both vaccinations, being a Black resident was still statistically significantly associated with higher risks of not receiving a vaccine (ORs varied between 1.5 and 3.3) and of having an undocumented vaccination status (ORs varied between 1.5 and 2.6).

DISCUSSION

This nationally representative study of nursing-home residents demonstrated that Blacks were less likely than were Whites to receive influenza and pneumococcus vaccinations, both in the overall population and in subgroups of residents. We also found that Blacks were less likely to have their vaccination history tracked and documented, which effectively decreased their immunization coverage. For pneumococcal infection, lack of vaccination created a barrier to receiving needed vaccines because of concerns about uncertain vaccination history and potential risk of revaccination.¹² These findings persisted after we controlled for multiple patient and facility covariates, supporting the notion (stated elsewhere in the literature) that minority nursing-home residents tend to receive care of “lower-tier” quality.¹⁶ In our study, it was immunization care that was of lower quality for minorities, despite the fact that nursing homes should be able to provide appropriate immunizations to all residents relatively easily and safely.

Compared with reports based on recent National Health Interview Surveys of people in the community,^{11,18} our estimate of the overall influenza vaccination rate in nursing homes

TABLE 3—Multivariate Predictors of Influenza and Pneumococcus Vaccination: National Nursing Home Survey, 2004

	Influenza Vaccination				Pneumococcal Vaccination			
	Unvaccinated Residents		Undocumented Residents		Unvaccinated Residents		Undocumented Residents	
	OR	P	OR	P	OR	P	OR	P
Black (vs White)	1.84	≤.001	1.85	.001	1.70	≤.001	1.95	≤.001
Age, y								
< 65	1.30	.04	1.09	.581	1.25	.03	1.19	.123
65-84	1.02	.811	0.96	.667	1.10	.085	1.04	.525
≥ 85 (Ref)	1.00		1.00		1.00		1.00	
Female gender	0.97	.763	0.88	.209	0.99	.829	0.97	.68
Veteran	0.72	.055	0.52	.006	0.99	.937	0.78	.195
Length of stay ≥ 6 mo	0.24	≤.001	0.30	≤.001	0.38	≤.001	0.41	≤.001
Payment source for past mo								
Medicare	1.55	.001	1.43	.032	1.23	.06	0.97	.8
Medicaid (Ref)	1.00		1.00		1.00		1.00	
Private	1.28	.079	0.93	.728	1.13	.319	1.17	.349
Other	1.24	.028	1.66	.001	1.03	.683	1.49	≤.001
No. of difficult ADLs	1.00	.468	1.00	.598	0.99	.035	1.00	.442
Indication of depressed mood	0.99	.904	0.90	.33	1.05	.464	1.05	.531
Any behavioral symptoms	0.86	.102	1.05	.655	0.95	.423	1.02	.825
Dementia	1.00	.966	0.81	.081	0.87	.059	0.90	.238
Heart disease	0.84	.05	0.83	.078	1.02	.766	0.80	.004
Chronic pulmonary disease	1.12	.291	1.10	.47	0.90	.143	0.98	.852
Asthma	1.04	.875	0.97	.899	0.84	.312	0.91	.627
Diabetes	1.23	.025	1.10	.42	0.94	.301	0.94	.422
Chronic renal disease	0.70	.177	1.01	.983	0.75	.105	1.09	.653
For-profit facility	1.40	.008	1.47	.048	2.12	≤.001	1.77	≤.001
No. of beds								
< 50 (Ref)	1.00		1.00		1.00		1.00	
50-99	1.59	.058	2.10	.015	1.10	.527	0.88	.566
100-199	1.72	.024	2.67	.001	1.13	.415	1.15	.515
≥ 200	1.87	.028	1.77	.204	1.06	.797	0.50	.071
Location								
Metropolitan (Ref)	1.00		1.00		1.00		1.00	
Micropolitan	0.75	.058	0.90	.688	0.92	.492	0.89	.54
Rural	0.50	≤.001	0.68	.143	1.02	.869	0.81	.265

Note. OR = odds ratio; ADLs = activities of daily living. ADLs include bed mobility, transfer, dressing, eating, toileting, personal hygiene, and bathing.

(76%) was higher than the self-reported rate of 65% among community-living elderly people (aged 65 years or older), whereas our estimated pneumococcus vaccination rate in nursing homes (49%) was lower than the corresponding community rate for elderly people (60%). These variations may reflect differences between the National Health Interview Surveys and the NNHS with regard to sampling and survey

methods, but they may also reflect systematic differences in immunization uptake between institutionalized and community-living populations. Nevertheless, our findings regarding racial disparities were consistent with evidence from community-based studies.¹⁸⁻²¹

Studies have suggested alternative reasons for the observed racial disparities in immunization rates among noninstitutionalized

persons, including barriers to access, lack of insurance, resistant attitudes toward vaccination, and system- and provider-level biases.^{18,20-22} However, compared with persons living in the community, nursing-home residents are constantly present and face minimal nonmedical costs for receiving vaccinations (e.g., no need to locate and drive to a clinic to obtain the vaccination). In addition, elderly residents and most disabled residents are covered by Medicare for their influenza and pneumococcus vaccinations, regardless of what kind of insurance is paying for their nursing home care. Therefore, neither access to care nor insurance is likely a major reason for the racial disparities found in this study. Finally, our analyses excluded those who were offered but refused the vaccination, which should obviate resistant attitudes and beliefs as a potential explanation of our findings. Indeed, our preliminary analyses revealed that 4.81% of Whites (551 of 11 448) and 4.77% of Blacks (66 of 1384) refused vaccination for influenza, and 5.31% of Whites (608 of 11 448) and 3.68% of Blacks (51 of 1384) refused pneumococcus vaccine. These preliminary results suggested a slightly higher resistance rate among White residents.

With these considerations, we believe that factors on the part of nursing homes and nursing staff most likely contributed to the lower immunization rate among Blacks. Our data (Table 1) showed that Blacks were more likely than were Whites to be covered by Medicaid; to be served by for-profit facilities, where poor-quality care is more frequently cited than in nonprofit facilities³⁰; and to be served by facilities located in urban areas, where segregated access to care is more common.³¹ These findings confirmed the common observation in the literature that Black patients tend to be clustered in nursing homes characterized by poor resources, understaffing, and care deficiencies.^{16,17} These “lower-tier” nursing facilities may show reduced commitment to effective immunization or preventive services in general. They could also lack the ability to maintain a centralized system (e.g., computer or log book) to track residents’ vaccination history, or to implement evidence-based immunization programs, such as standing orders,³² thereby contributing to the racial disparities found in this study. Our stratified analyses (Table 4) suggested

TABLE 4—Racial Disparities in Influenza and Pneumococcal Vaccination, by Resident and Facility Characteristics: National Nursing Home Survey, 2004

	Influenza Vaccination				Pneumococcus Vaccination			
	Unvaccinated Residents		Undocumented Residents		Unvaccinated Residents		Undocumented Residents	
	OR	P	OR	P	OR	P	OR	P
Patient type								
Age < 65 y		.112		.296		≤.001		.013
Black	1.51		1.36		2.40		1.92	
White (Ref)	1.00		1.00		1.00		1.00	
Age ≥ 65 y		≤.001		≤.001		.001		≤.001
Black	1.95		2.02		1.58		1.99	
White (Ref)	1.00		1.00		1.00		1.00	
Length of stay < 6 mo		.006		.003		.032		≤.001
Black	1.69		2.00		1.47		2.01	
White (Ref)	1.00		1.00		1.00		1.00	
Length of stay ≥ 6 mo		≤.001		.035		≤.001		≤.001
Black	1.91		1.64		1.80		1.87	
White (Ref)	1.00		1.00		1.00		1.00	
Medicaid		≤.001		.025		≤.001		≤.001
Black	1.90		1.56		1.82		2.01	
White (Ref)	1.00		1.00		1.00		1.00	
Non-Medicaid		.004		.001		.082		.005
Black	1.75		2.56		1.35		1.82	
White (Ref)	1.00		1.00		1.00		1.00	
Facility type								
For profit		≤.001		≤.001		.001		≤.001
Black	2.11		1.94		1.64		2.01	
White (Ref)	1.00		1.00		1.00		1.00	
Nonprofit		.744		.092		.029		.006
Black	1.09		2.10		1.53		2.19	
White (Ref)	1.00		1.00		1.00		1.00	
Large (≥ 100 beds)		.002		.004		≤.001		≤.001
Black	1.80		1.89		1.83		2.14	
White (Ref)	1.00		1.00		1.00		1.00	
Small (< 100 beds)		.001		.07		.131		.213
Black	1.96		1.63		1.32		1.35	
White (Ref)	1.00		1.00		1.00		1.00	
Rural		≤.001		.164		.101		.016
Black	3.31		2.06		1.55		2.49	
White (Ref)	1.00		1.00		1.00		1.00	
Nonrural		≤.001		.002		≤.001		≤.001
Black	1.78		1.83		1.71		1.94	
White (Ref)	1.00		1.00		1.00		1.00	

Note. OR=odds ratio. Multinomial logistic regression models controlled for resident and facility characteristics.

that the effect of these lower-tier facilities might persist even for more homogeneous patient groups (e.g., Medicaid patients) or facility types (e.g., for-profit or urban).

Furthermore, studies of community-living elderly people have reported that racial disparities in influenza and pneumococcus vaccinations may be partly explained by the fact that

primary care practitioners are less likely to recommend vaccinations to their Black patients than to their White patients.^{18,20,21} If similar provider effects exist in the nursing-home setting, we would expect that nursing-home staff may tend not to remind Black residents of appropriate vaccinations or to recommend them, eventually leading to fewer Black residents being vaccinated.

In October 2005, the federal Centers for Medicare and Medicaid Services required that, as a condition of participation in Medicare or Medicaid programs, all certified nursing homes offer their residents influenza and pneumococcus vaccines and record patients' immunization history.³³ According to these requirements, each resident should be vaccinated unless vaccination is medically contraindicated, the resident or a legal representative refuses vaccination, or the vaccine is not available because of shortage. The Centers for Medicare and Medicaid Services also started reporting facility immunization rates in 2005 on its "Nursing Home Compare" Web site (www.medicare.gov/NHCompare). This report is available to the public and is expected to encourage improvement in nursing home vaccination coverage through public scrutiny. The effect of these governmental efforts is yet to be evaluated. Our study provides baseline rates of the year before these new efforts came into effect, which can be used as benchmarks of program evaluations. Our findings regarding racial disparities also suggest that in addition to these generic governmental approaches, intervention programs (such as staff education) that target facilities housing mostly minority residents may be more cost-effective in improving nursing home immunization coverage.

Strengths of this study included the large and representative sample of nursing-home residents, the high response rate, and confirmation of vaccination status through medical charts and other documents. This study also had several limitations. First, we focused on Black and White residents; we did not have enough data for residents of other races/ethnicities to permit meaningful analyses. Second, our analyses were cross-sectional and therefore could determine associations but not causal effects. Third, for residents with an undocumented vaccination status, we did not have additional source of information to verify whether they had or had not received vaccines, and we could

not further examine the implications of undocumented status. Finally, although we controlled for resident covariates and several nursing-home covariates using multivariate regression and stratification, other facility variables that were not included in the analyses could mediate a part of the observed racial disparities. Obtaining and examining additional facility variables would also be useful for exploring the reasons for the observed racial disparities, although that is beyond the scope of our study.

Despite these limitations, our study revealed that among US nursing-home residents, Blacks were less likely than were Whites to receive influenza and pneumococcus vaccinations and to have documentation of their vaccination history. Further studies are necessary to elicit the reasons underlying this finding that may be unique to the nursing-home setting. In addition to the recent government efforts that were designed to improve overall vaccination coverage in nursing homes, our findings suggest that targeted programs addressing racial disparities in immunization rates in nursing homes are warranted. ■

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Contributors

Y. Li conceptualized and designed the study, obtained the data, performed statistical analyses, and drafted and revised the article. D. B. Mukamel participated in the design of the study, assisted with data analyses, and contributed to revision of the article.

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